

2. LINE SPECTRA OF ELEMENTS

UNIT 5 - ATOMIC STRUCTURE

CH40S MR. WIEBE

1

RECAP...

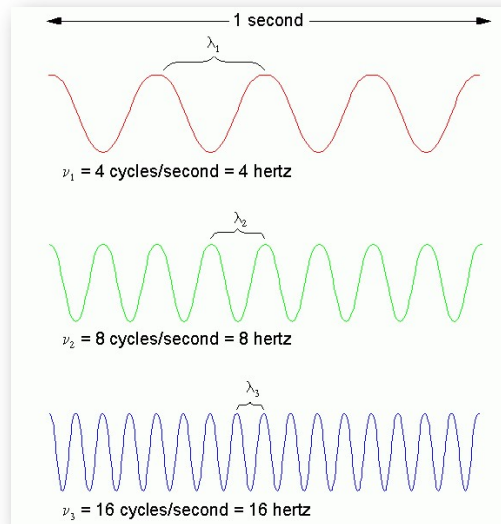
- Light (EMR) can be categorized by wavelength and frequency into a spectrum.
- Max Planck noticed that when matter absorbs waves of EMR (ie. Heating up a metal object), it doesn't do so in a continuous fashion. It does so in "chunks" or quanta called photons.
- The energy contained by each photon is directly proportional to the frequency of the EMR.

Slide 2

2

RELATIONSHIP BETWEEN VARIABLES

Long
Wavelength
=
Low Frequency
=
Low ENERGY



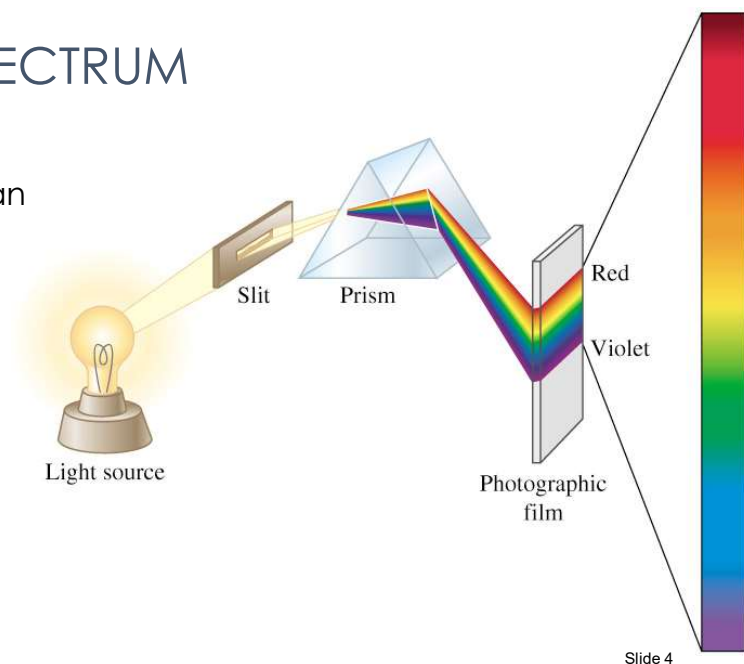
Short
Wavelength
=
High Frequency
=
High ENERGY

3

CONTINUOUS SPECTRUM

When white light (such as light from the sun or from an incandescent light bulb) is passed through a prism, it produces a continuous spectrum of colours.

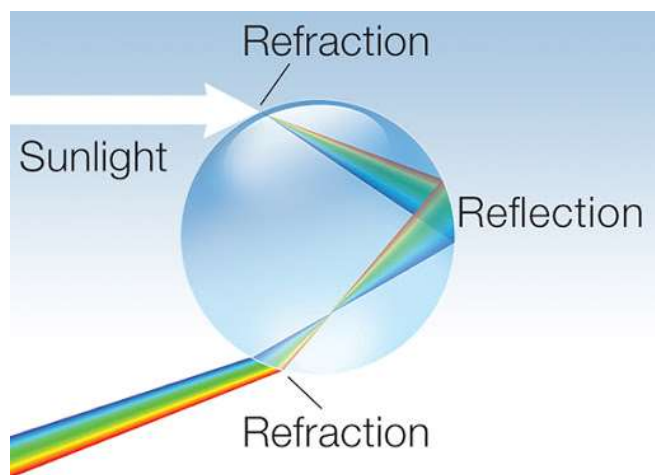
White light is comprised of photons of every wavelength in the visible spectrum.



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CONTINUOUS SPECTRUM

Rainbows are formed when raindrops act as prisms, separating the sunlight into all its component wavelengths to produce a continuous spectrum of photons.



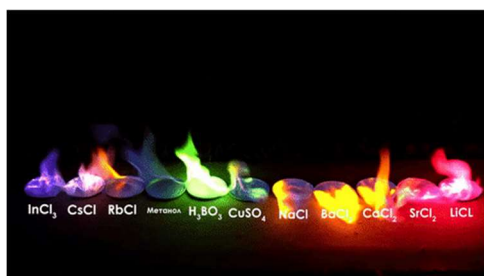
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FLAME COLOURS

When heat or electrical current are applied to samples of elements, different colours of light are produced.



Every element produces a distinctly unique colour.

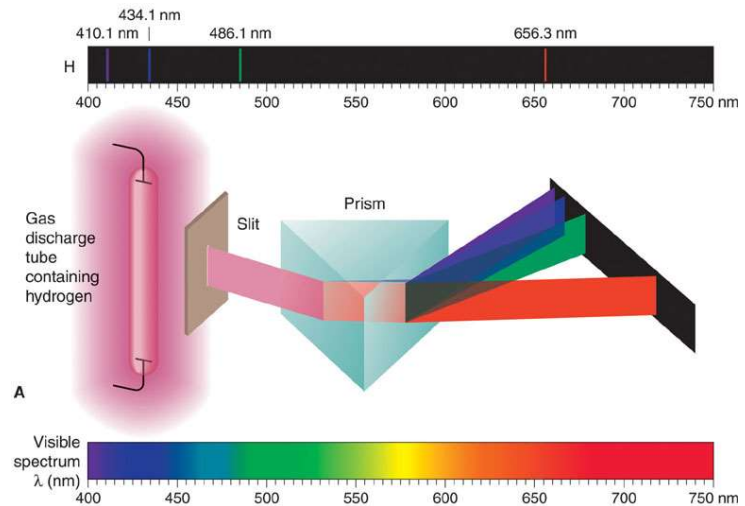


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ATOMIC LINE SPECTRA

When this light is passed through a prism, a line spectrum is produced rather than a continuous spectrum.

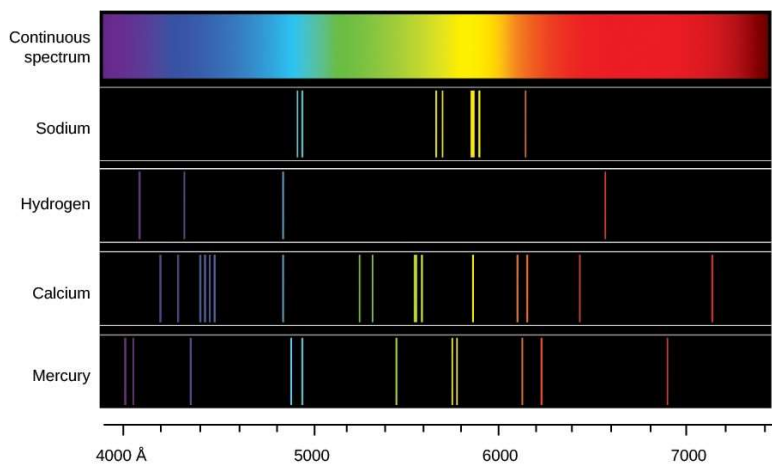
For example, when hydrogen atoms are excited and the light produced is passed through a prism, only 4 wavelengths of light are produced.



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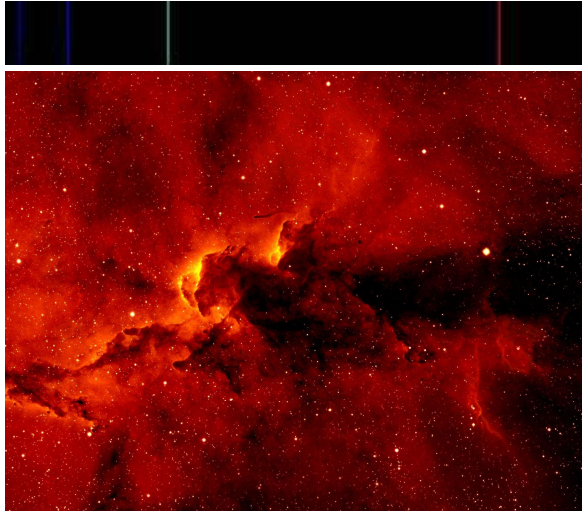
EMMISSION LINE SPECTRA

Every element has a unique line spectrum that can be used to identify them, like fingerprints.



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EMMISSION LINE SPECTRA

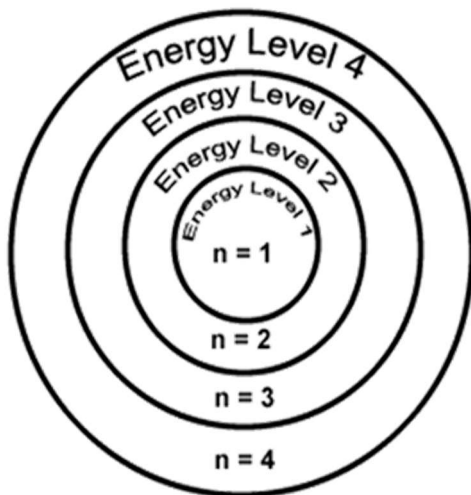


When light from space is collected and passed through a prism, much of the time the line spectra match the line spectrum of hydrogen.

This is how we know 99.9% of our known universe is comprised of hydrogen.

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WHY DOES THIS HAPPEN?



Remember that electrons are found in energy levels around the nucleus of atoms.

The farther away from the nucleus the electron (the higher the energy level), the more energy the electron must have to stay there.

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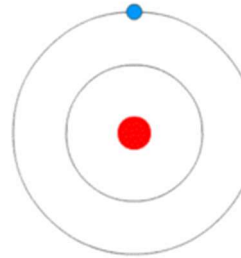
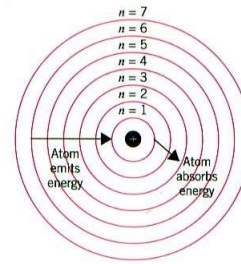
WHY DOES THIS HAPPEN?

When an atom of hydrogen absorbs energy, the electron also increases in energy.

As a result, the electron gets promoted to a higher energy level. The atom is now in an excited state.

When the electron loses that energy, it returns to its natural energy level (ground state).

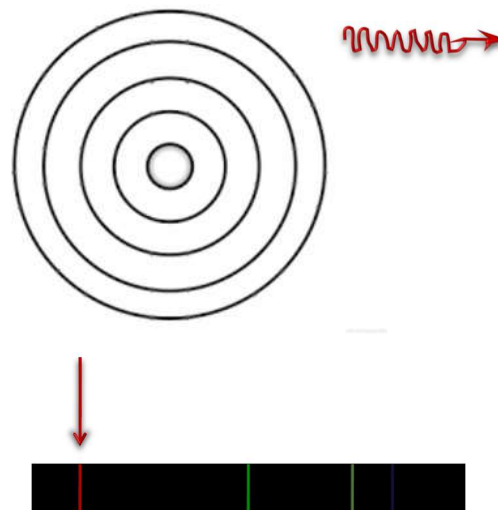
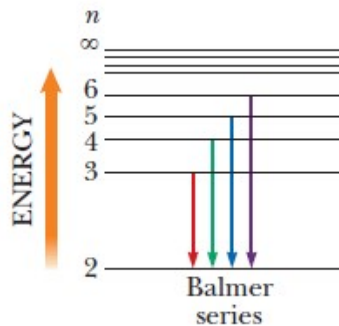
The energy lost as the electron falls is given off as a photon of light of equivalent energy.



The time it takes for an electron to rise and fall is measured in zeptoseconds (10^{-21})!

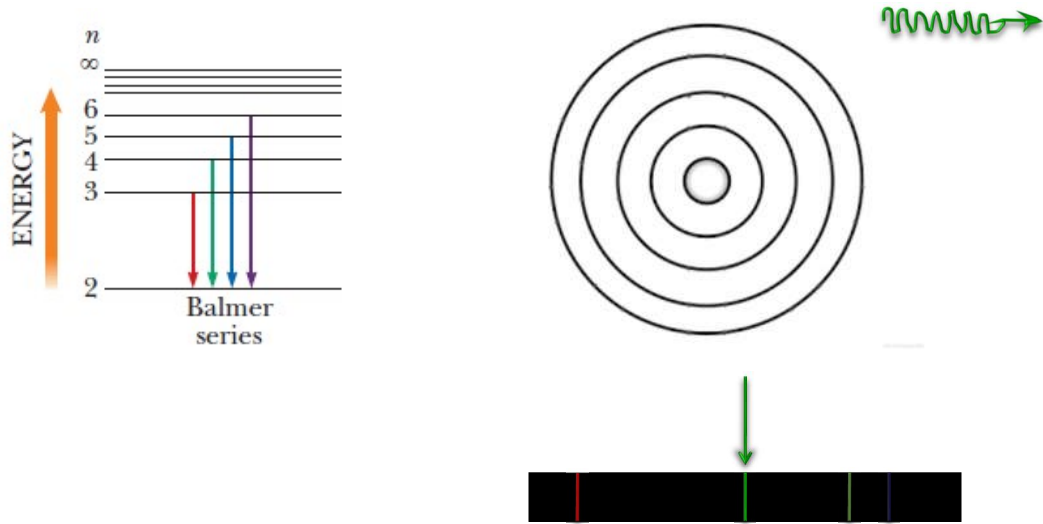
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THE BALMER SERIES



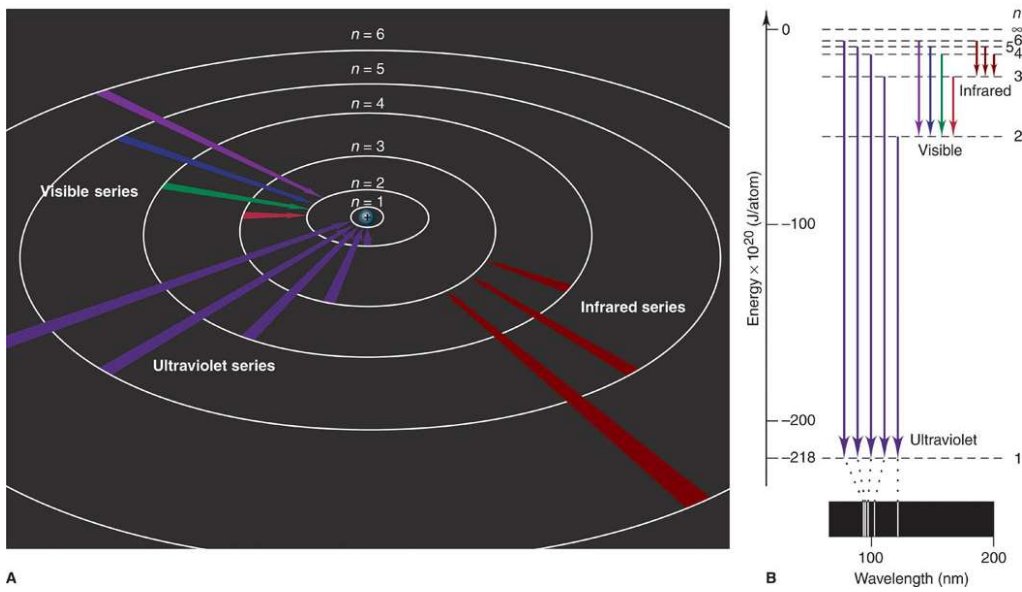
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THE BALMER SERIES



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THE BOHR MODEL REVISED



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